

Version: 1.0

TECHNICAL SPECIFICATION

MODEL NO: ED060XH7

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Please contact E Ink or its agent for further information.

☐ Customer's Confirmation

Customer _____

Date _____

By _____

☐ E Ink's Confirmation

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Revision History

Rev.	Issued Date	Revised Contents
1.0	2015-12-20	New

TECHNICAL SPECIFICATION

CONTENTS

<i>NO.</i>	<i>ITEM</i>	<i>PAGE</i>
-	Cover	1
-	Revision History	2
-	Contents	3
1	General Description	4
2	Features	4
3	Mechanical Specifications	4
4	Mechanical Drawing of Display module	5
5	Input/Output Interface	6
6	Touch Panel Characteristic	8
7	Display Module Electrical Characteristics	10
8	Power Sequence	19
9	Optical Characteristics	21
10	Handling ,Safety And Environmental Requirements And Remark	23
11	Reliability test	25
12	Border definition	26
13	Block Diagram	27

1. General Description

ED060XH7 is a reflective electrophoretic E Ink[®] technology display module based on active matrix TFT substrate featuring capacitive touch panel with front light . It has 6” active area with 758 x 1024 pixels, the display is capable to display images at 2-16 gray levels (1-4 bits) depending on the display controller and the associated waveform file it used.

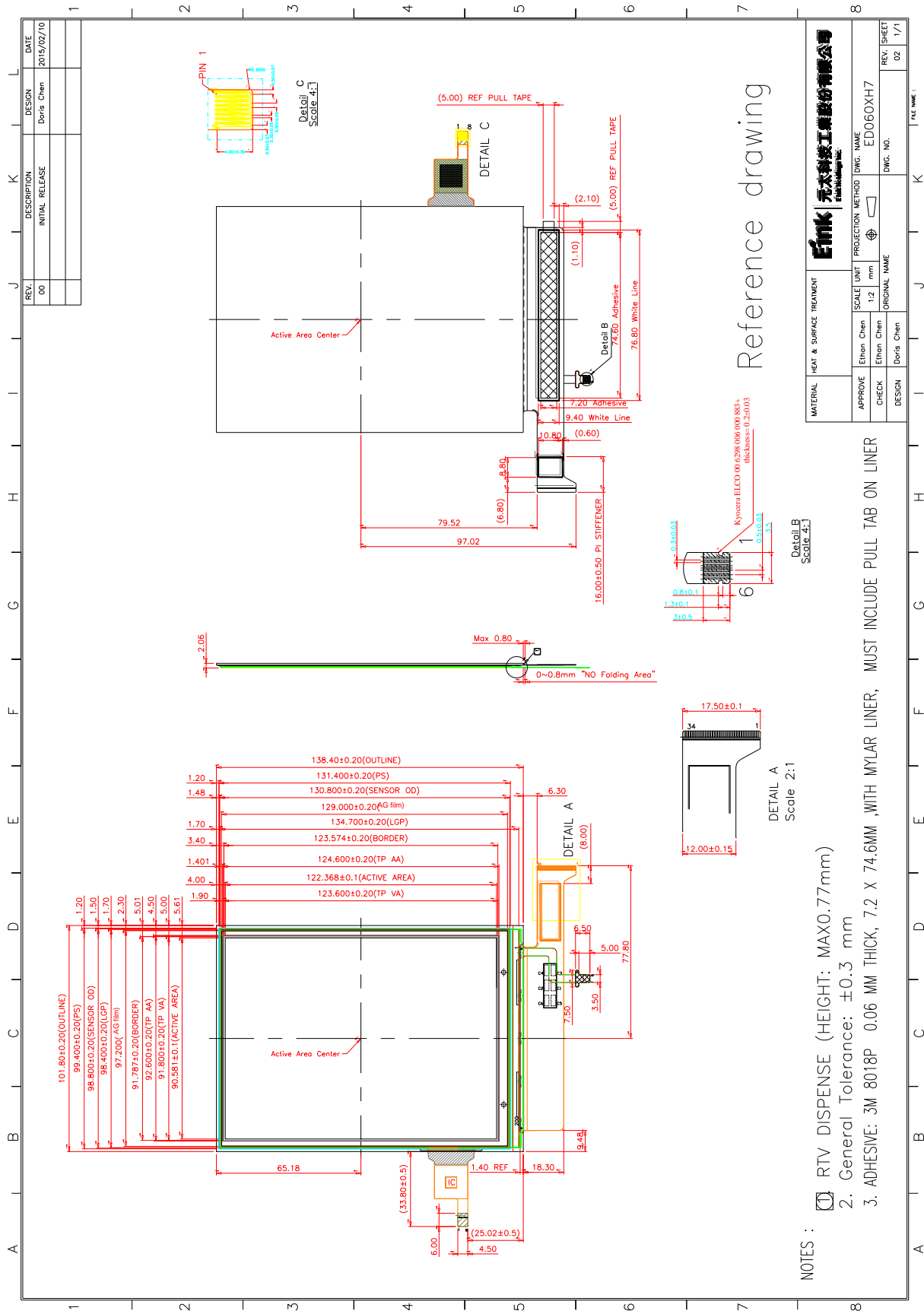
2. Features

- Carta High contrast reflective/electrophoretic technology
- 758 x 1024 dots resolution
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Landscape, portrait mode
- Capacitive touch with film type
- Front light module

3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	6.0 (3:4 diagonal)	Inch	
Display Resolution	758 (H)×1024(V)	Pixel	
Active Area	90.581 (H)×122.368 (V)	mm	
Pixel Pitch	0.1195 (H)×0.1195 (V)	mm	
Pixel Configuration	Square		
Outline Dimension	101.80(W)×138.40(H)×2.06(D) (panel area height)	mm	
Module Weight	47.6 ±4	g	
Number of Gray	16 Gray Level (monochrome)		
Display operating mode	Reflective mode		

4. Mechanical Drawing of Display Module



5. Input/Output Interface

5-1) Connector type: FH34S-34S-0.5SH(50)-Hirose

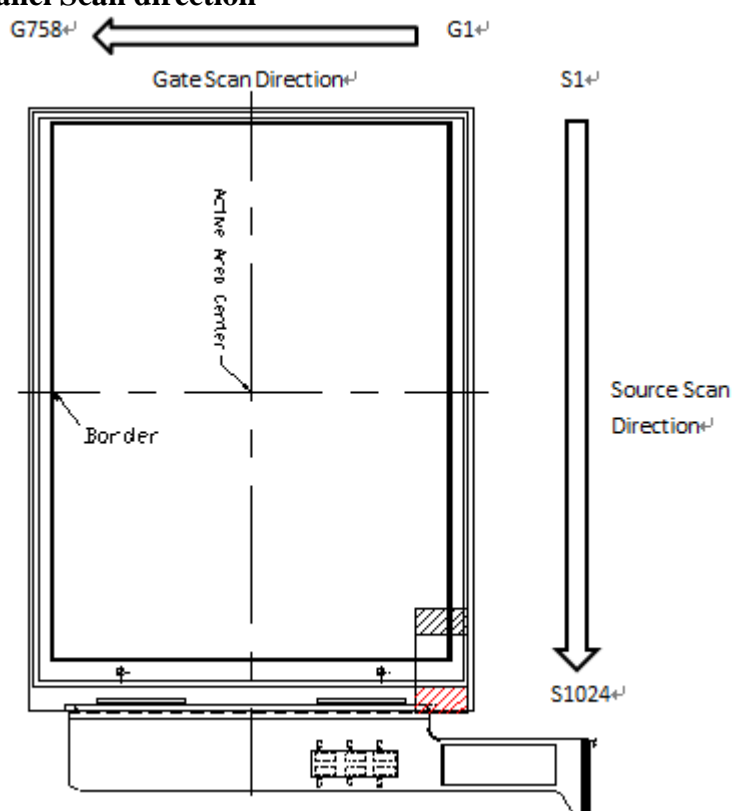
Pin Assignment

Pin #	Signal	Description	Remark
1	VNEG	Negative power supply source driver	
2	VGL	Negative power supply gate driver	
3	VSS	Ground	
4	NC	NC	
5	NC	NC	
6	VDD	Digital power supply drivers (3.3V)	
7	VSS	Ground	
8	XCL	Clock source driver	
9	VSS	Ground	
10	XLE	Latch enable source driver	
11	XOE	Output enable source driver	
12	XSTL	Start pulse source driver	
13	D0	Data signal source driver	
14	D1	Data signal source driver	
15	D2	Data signal source driver	
16	D3	Data signal source driver	
17	D4	Data signal source driver	
18	D5	Data signal source driver	
19	D6	Data signal source driver	
20	D7	Data signal source driver	
21	VCOM	Common connection	
22	NC	NC	
23	NC	NC	
24	NC	NC	
25	NC	NC	
26	VSS	Ground	
27	MODE 1	Output mode selection gate driver	
28	CKV	Clock gate driver	
29	SPV	Start pulse gate driver	
30	NC	NC	
31	BORDER	Border connection	
32	VSS	Ground	
33	VPOS	Positive power supply source driver	
34	VGH	Positive power supply gate driver	

5-2) Pin assignment of LED circuit

No.	Pin assignment
1	Anode
2	Anode
3	Dummy
4	Dummy
5	Cathode
6	Cathode

5-3) Panel Scan direction



6.Touch Panel Characteristic

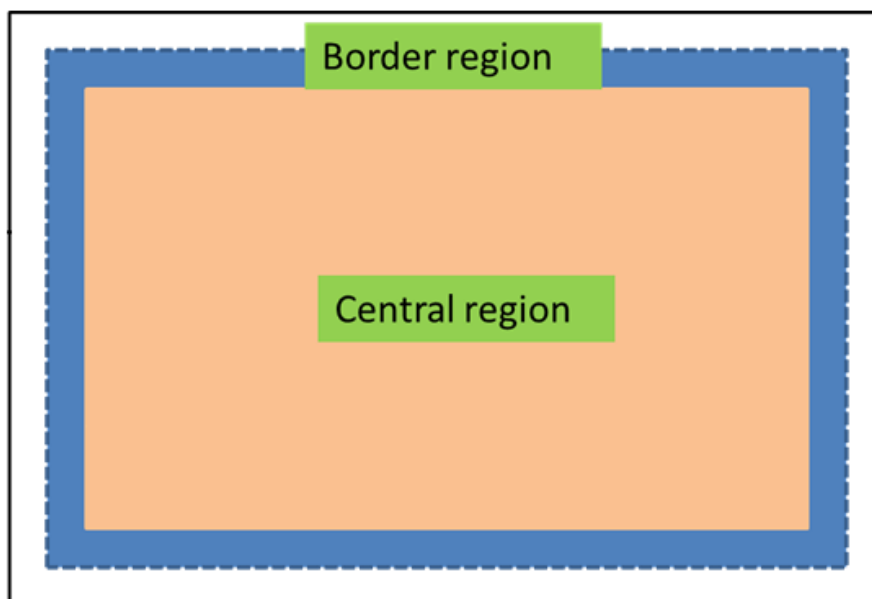
6-1) Electric Characteristic

Item	Spec.	
Chipset	EKT2232ALW (QFN48)	
Pin Assignment	Pin N	Assignment
	1	DGND
	2	VDD
	3	Reset
	4	INT
	5	SDA
	6	SCL
	7	NC
	8	NC
Supply Voltage	VDD:2.8V-3.6V	
Power Consumption	Active(Single touch)power consumption 5mA(3.3V); Idle power consumption 2.5mA(3.3V); Sleep power consumption 20μ A(3.3V)	
Oscillator Frequency	10 MHz	
Interface	I2C	
Support OS	Android	
Support Points	1+G	
Resolution	1280 X 832	
Max. Report Rate	100Hz	

Touch function : 1 point + gesture

Symbol		Specification	Remark
Sensitivity		8mm	
Linearity	Center	+/-2mm	No display refresh
	Border	+/-4mm	
Accuracy	Center	+/-2mm	No display refresh
	Border	+/-4mm	
Jitter	Center	+/-2mm	No display refresh
	Border	+/-4mm	

Reporting rate : 85Hz



6.2) Absolute Maximum Rating

Items	Unit	Specifications	
		Top-axis	Bot-axis
Isolation Between Bars	MΩ	>20MΩ	
Wire resistance(the longest wire)	KΩ	1.12	1.03
Mesh resistance	KΩ	4.32	5.47
Non-conductance	/	No conduction	No conduction

7. Display Module Electrical Characteristics

7-1) Absolute Maximum Ratings:

Parameter	Symbol	Rating	Unit	Remark
Logic Supply Voltage	VDD	-0.3 to +7	V	--
Positive Supply Voltage	V _{POS}	-0.3 to +18	V	--
Negative Supply Voltage	V _{NEG}	+0.3 to -18	V	--
Max .Drive Voltage Range	V _{POS} - V _{NEG}	36	V	--
Supply Voltage	VGH	-0.3 to +45	V	--
Supply Voltage	VGL	-25.0 to +0.3	V	--
Supply Range	VGH-VGL	-0.3 to +45	V	--
Operating Temp. Range	TOTR	0 to +50	°C	--
Storage Temperature	TSTG	-25 to +70	°C	--

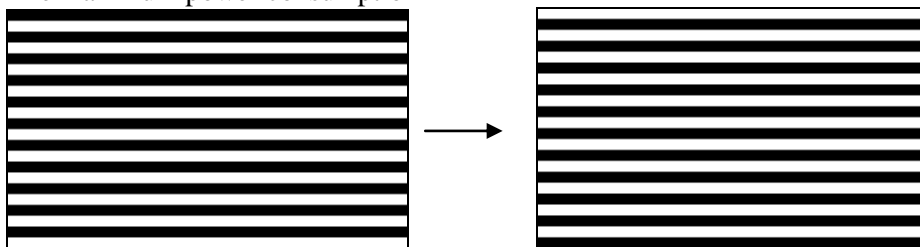
7-2) Display Module DC characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal ground	V_{SS}		-	0	-	V
Logic Voltage supply	V_{DD}		3.0	3.3	3.6	V
	I_{VDD}	$V_{DD}=3.3V$	-	1.5	4.4	mA
Gate Negative supply	V_{GL}		-21	-20	-19	V
	I_{GL}	$V_{GL}=-20V$	-	1.3	8.8	mA
Gate Positive supply	V_{GH}		21	22	23	V
	I_{GH}	$V_{GH}=22V$	-	1.4	3.9	mA
Source Negative supply	V_{NEG}		-15.4	-15	-14.6	V
	I_{NEG}	$V_{NEG}=-15V$	-	10.4	44	mA
Source Positive supply	V_{POS}		14.6	15	15.4	V
	I_{POS}	$V_{POS}=15V$	-	10.3	46.2	mA
Border supply	V_{COM}		-3.5	Adjusted	-1.1	V
Asymmetry source	V_{Asym}	$V_{POS}+V_{NEG}$	-800	0	800	mV
Common voltage	V_{COM}		-3.5	Adjusted	-1.1	V
	I_{COM}		-	0.3	-	mA
Panel Power	P		-	380	1650	mW
Standby power panel	P_{STBY}		-	-	0.4	mW
Operating temperature			0	-	50	°C
Storage temperature			-25	-	70	°C

- The maximum power consumption is measured using 85Hz waveform with following pattern transition: from pattern of repeated 1 consecutive black scan lines followed by 1 consecutive white scan line to that of repeated 1 consecutive white scan lines followed by 1 consecutive black scan lines. (Note 7-1)
- The Typical power consumption is measured using 85Hz waveform with following pattern transition: from horizontal 4 gray scale pattern to vertical 4 gray scale pattern. (Note 7-2)
- The standby power is the consumed power when the panel controller is in standby mode.
- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by E Ink.
- Vcom is recommended to be set in the range of assigned value $\pm 0.1V$.
- The maximum I_{COM} inrush current is about 600 mA

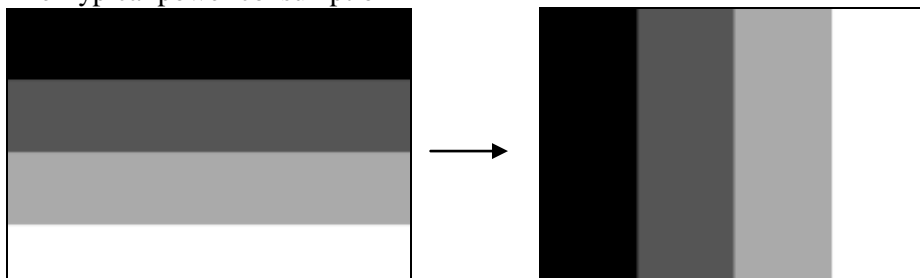
Note 7-1

The maximum power consumption



Note 7-2

The Typical power consumption



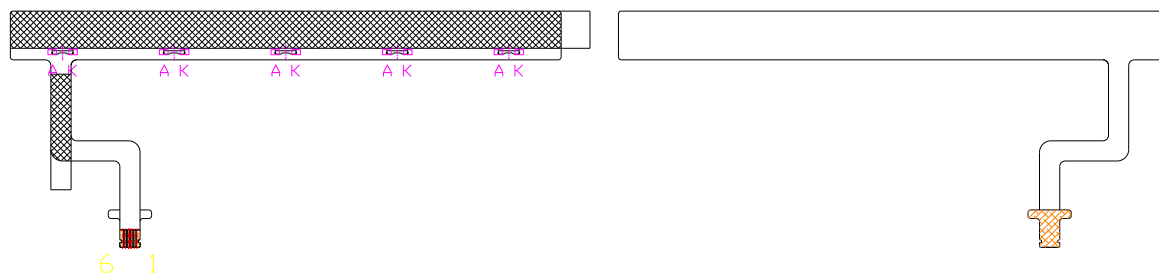
7-3) Recommended driving condition for Front light

GND = 0 V , $T_a = 25^{\circ}C$

Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED Front light	V_{LED}	14	15.5	17	V	Serial 5 pcs
Supply current of LED Front light	I_{LED}	--	20	--	mA	
Front light Power Consumption	P_{LED}	280	310	340	mW	Note 6-3

Note 7-3 : $I_{LED}=20$ mA with 1-serial LED circuit(5 LEDs)

Note 7-4 : E Ink recommend to set $I_{LED}=10$ mA as minimum on device.

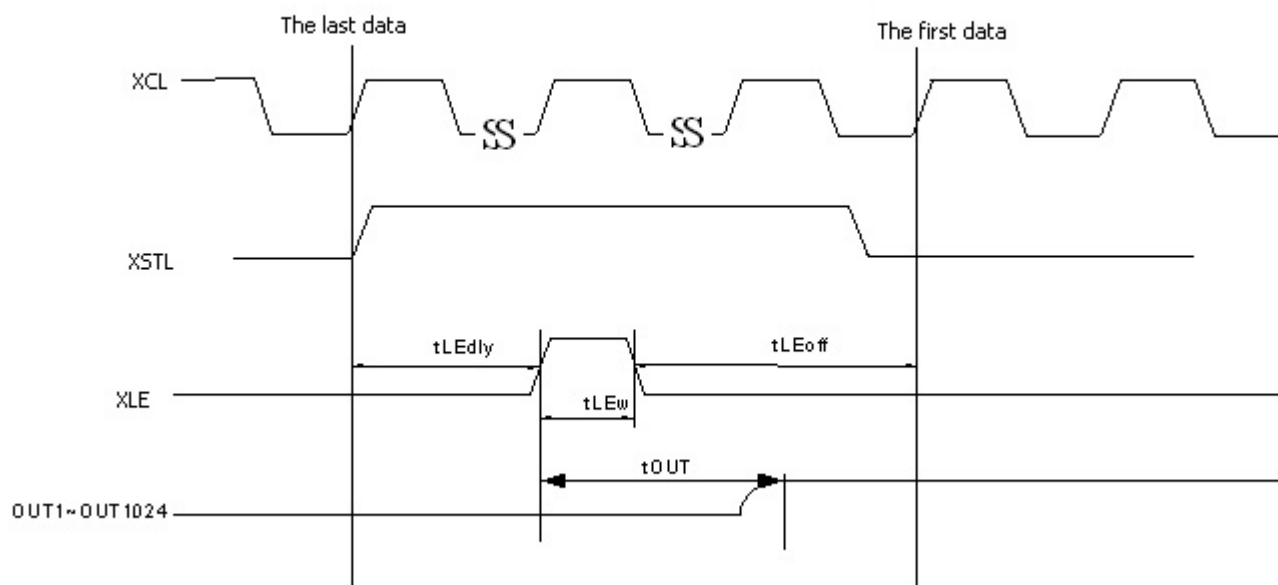


7-4) Display Module AC characteristics

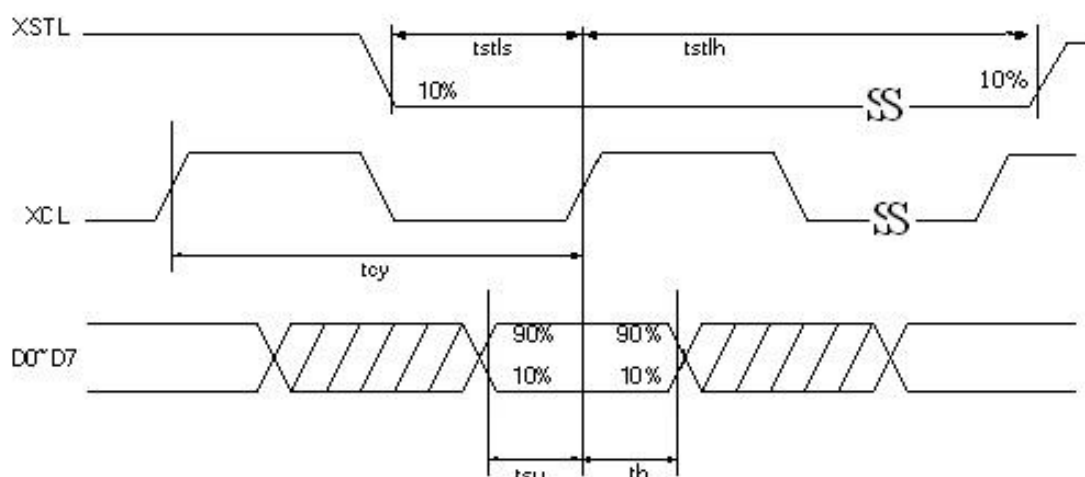
VDD=3.0V to 3.6V, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum “L” clock pulse width	twL	0.5	-	-	us
Minimum “H” clock pulse width	twH	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	25	-	-	ns
D0 .. D7 setup time	tsu	12	-	-	ns
D0 .. D7 hold time	th	12	-	-	ns
XSTL setup time	tstls	12	-	-	ns
XSTL hold time	tstlh	12	-	-	ns
XLE on delay time	tLEdly	40	-	-	ns
XLE high-level pulse width (When VCC=3.0V to 3.6V)	tLEw	150	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV(C _{load} =200pF)	tout	-	-	12	us

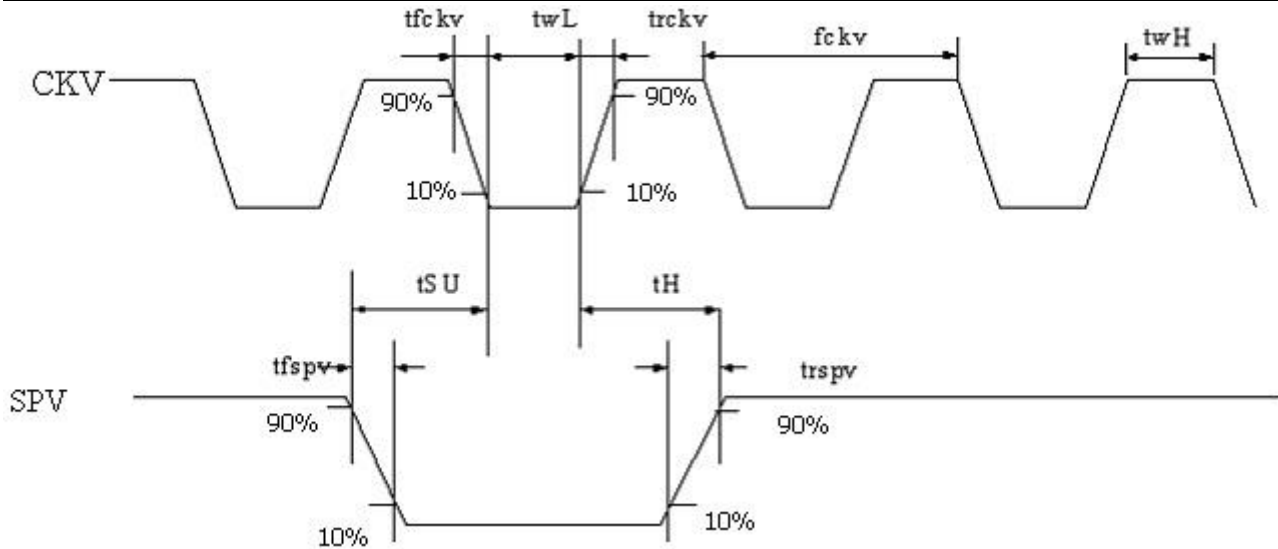
OUTPUT LATCH CONTROL SIGNALS



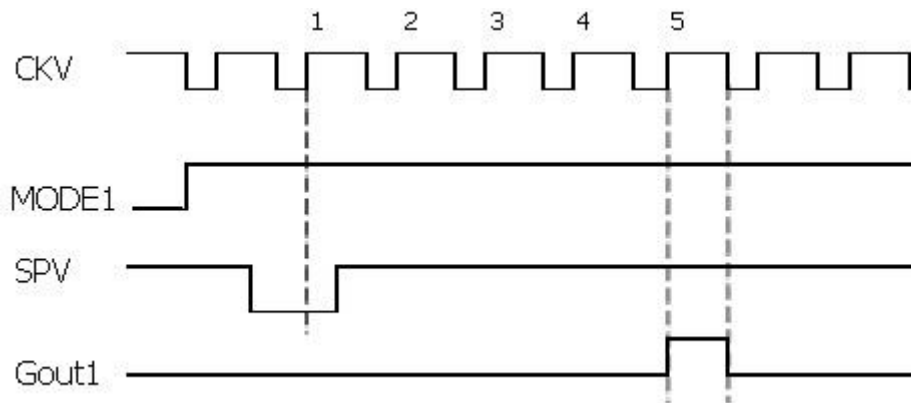
CLOCK & DATA TIMING



CKV & SPV TIMING



GATE OUTPUT TIMING



Note : First gate line on timing

After 5CKV , gate line is on .

7-5) Controller Timing

This timing mode is depicted on Figure 1 and Figure 2 and it refers to timing of Source Driver Output Enable (SDOE) and Gate Driver Clock (GDCK). Note, that in this mode LGON follows GDCK timing.

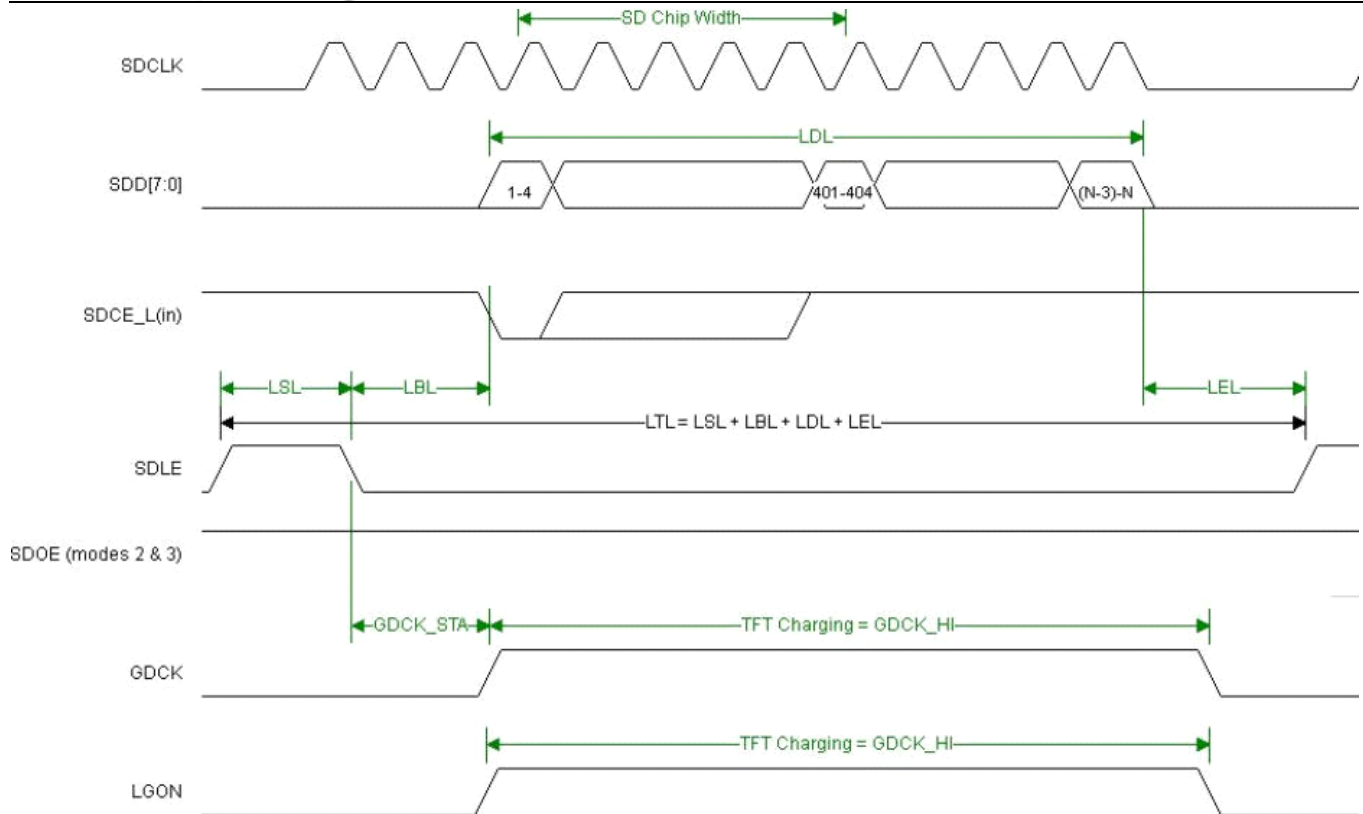


Figure 1 Line Timing in Mode 3

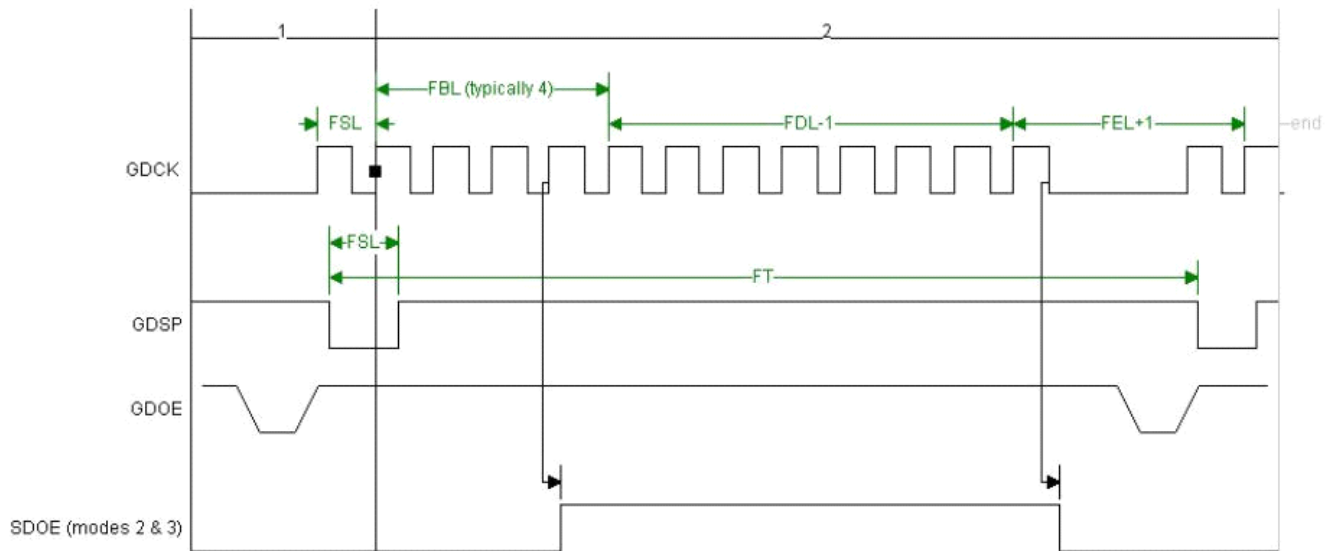


Figure 2 Frame Timing in Mode 3

Table Timing Parameters Table

Mode	3	Resolution 1024x758				
SDCK [MHz]	20					
Pixels Per SDCK	4					
Line Parameters[SDCK]	LSL	LBL	LDL	LEL	GDCK_STA	LGONL
	6	6	256	38	4	262
Line Parameters[us]	-	-	-	-	-	-
	0.3	0.3	12.8	1.9	0.2	13.10
Frame Parameters [lines]	FSL	FBL	FDL	FEL	-	FR [Hz]
	2	4	758	5	-	84.99
Frame Parameters [us]					-	-
	30.60	61.20	11597.4	76.50	-	-

Note 1: For parameters definition, see Section 6. Active Matrix Electronic Paper Display Timings

Note 2: For Isis Controller GDCK_STA and LGONL are not settable parameters; GDCK_STA = LBL, LGONL = LDL+0.5

Note 3: For Freescale SoC GDOE Low pulse represent FSL and GDSP pulses with the first period of FBL

Note 4:

SDCLK = XCL

SDD[7:0] = D0~D7

SDCE_L(in) = XSTL

GDCK = CKV

GDSP = SPV

GDOE = Mode 1

SDOE = XOE

7-6). Refresh Rate

The module ED060XH7 is applied at a maximum screen refresh rate of 85Hz.

	Min	Max
Refresh Rate	-	85Hz

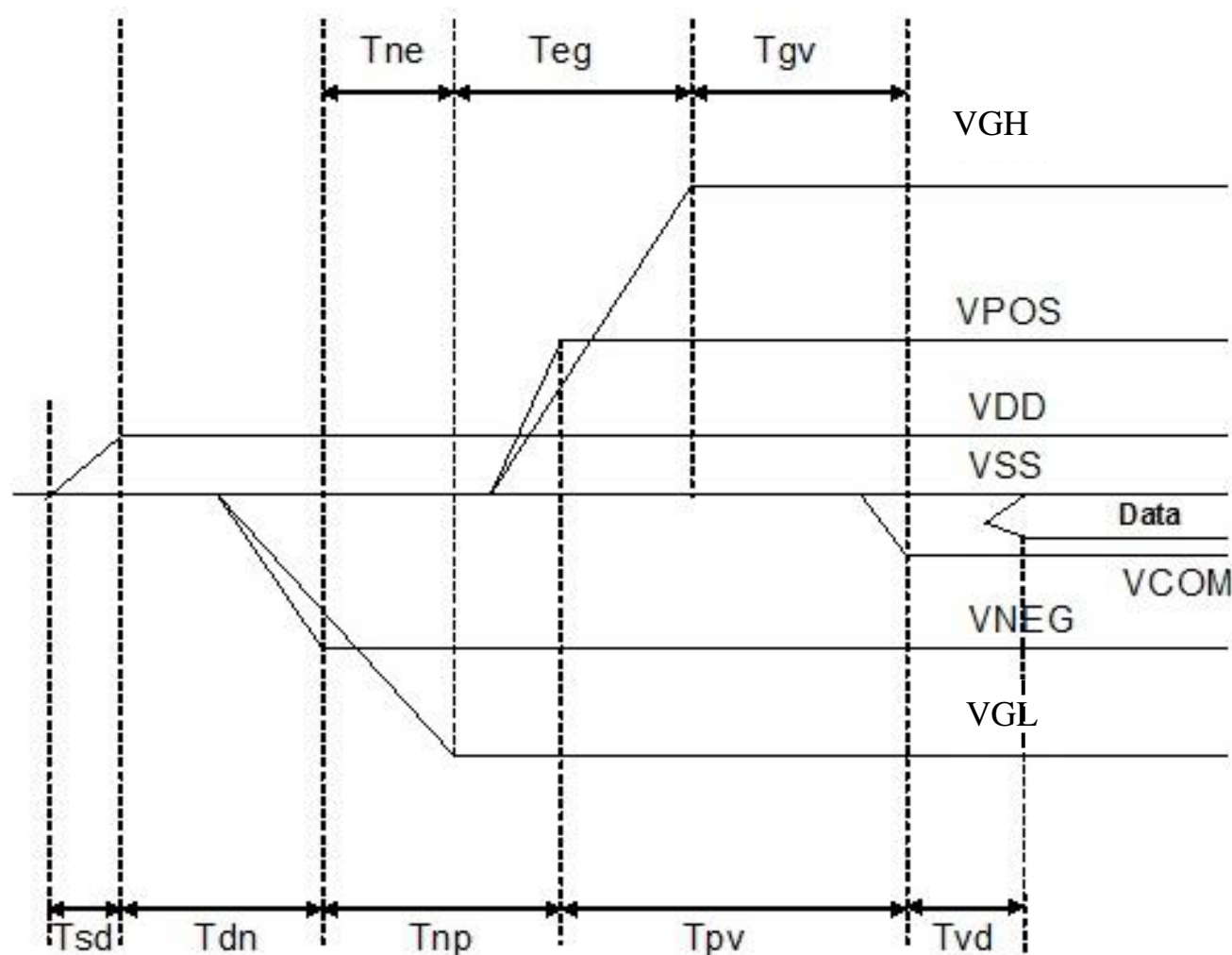
8.Power Sequence

Power Rails must be sequenced in the following order :

1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

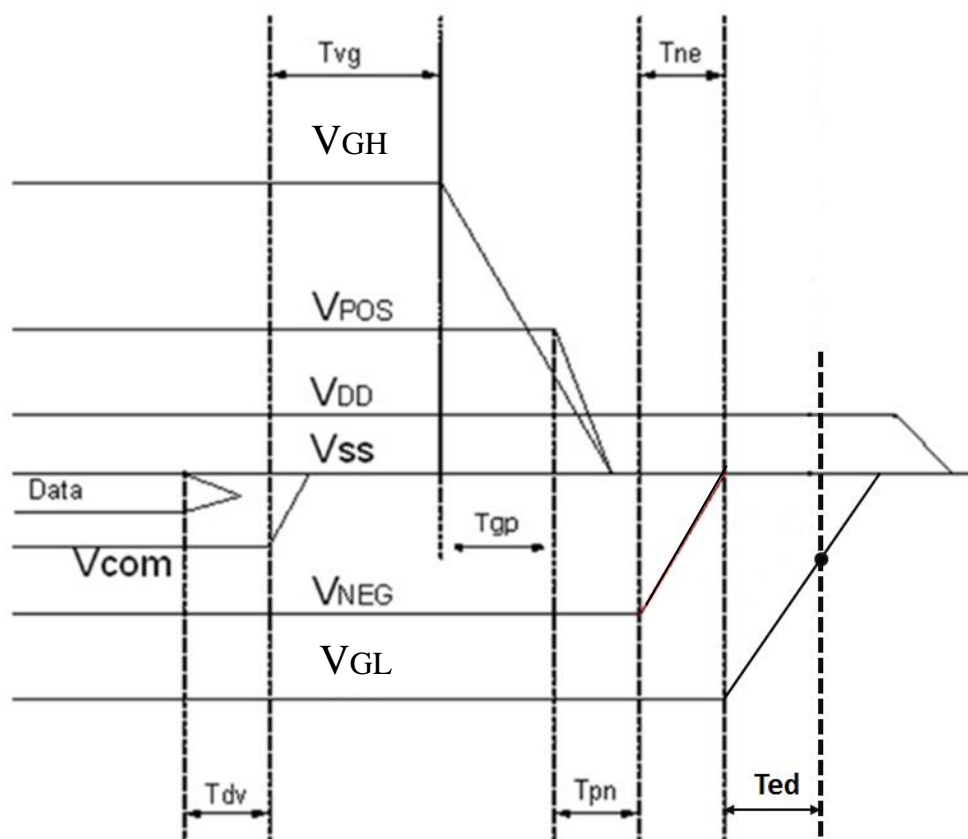
2. VSS → VDD → VGL → VGH (Gate driver)

POWER ON



	Min	Max
Tsd	30us	-
Tdn	100us	-
Tnp	1000us	-
TPv	100us	-
Tvd	100us	-
Tne	0us	-
Teg	1000us	-
Tgv	100us	-

POWER OFF



	Min	Max
Tdv	100 μ s	-
Tvg	0 μ s	-
Tgp	0 μ s	-
Tpn	0 μ s	-
Tne	0 μ s	-
Ted	0.5 s	Discharged point @ -7.4 Volt

Note8-1 : Supply voltages decay through pull-down resistors

Note8-2 : Begin to turn off VGL power after VNEG and VPOS are completely or almost discharged to GND state.

Note8-3 : VGL must remain negative of Vcom during decay period

9. Optical characteristics

9-1) Specifications

Measurements are made by PR655 with MS-75 or equivalent SepctaScan Colorimeter with that the illumination is at an angle 45° from the perpendicular at the center of sample surface, and the detector is perpendicular unless otherwise specified.

T = 25°C

Symbol	Parameter	Conditions		Min	Typ.	Max	Unit	Note
R	Reflectance	White	Front Light off	38	45	-	%	Note 9-1
Gn	N _{th} Grey	-		-	DS+(WS-DS)×n /(m-1)	-	L*	-
	Level							
CR	Contrast Ratio	-		12	17	-	-	Note 9-2
Brightness		θ=0°	Front Light On	-	200	-	cd/m ²	Note 9-4
White Chromaticity		x		0.27	0.31	0.35	-	-
		y		0.29	0.33	0.37	-	
Luminance Uniformity		θ=0°		60	70	-	%	Note 9-5
CR	Contrast Ratio	θ=0°		12	16	-	-	Note 9-6

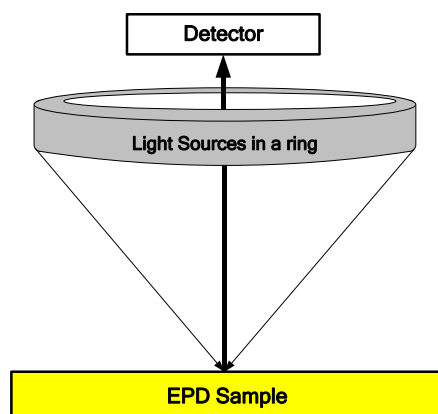
WS: White state , DS: Dark state, Gray state from Dark to White :DS 、G1 、G2... 、Gn... 、Gm-2 、WS
m:4 、8 、16 when 2 、3 、4 bits mode

Note 9-1: Luminance meter: Eye – One Pro Spectrophotometer

9-2) Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (Rl) and the reflectance in a dark area (Rd):

$$CR = Rl/Rd$$



9-3) Reflection Ratio

The reflection ratio is expressed as:

$$R = \text{Reflectance Factor}_{\text{white board}} \times (L_{\text{center}} / L_{\text{white board}})$$

L_{center} is the luminance measured at center in a white area ($R=G=B=1$). $L_{\text{white board}}$ is the luminance of a standard white board. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.

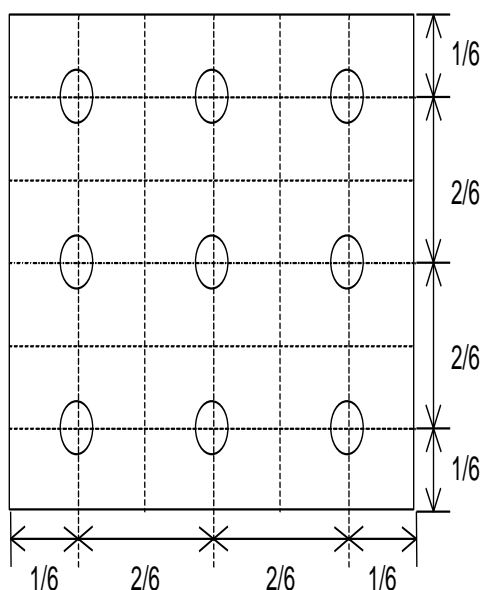
9-4) Optical characteristics are determined after the front light has been 'ON' and stable for approximately 60 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the EPD display surface at a viewing angle of Φ and θ equal to 0°.

The typical luminance value is measured at LED current 20 mA.

9-5) The uniformity is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

Ambient illumination : < 1 Lux
Measuring direction : Perpendicular to the surface of module
The test pattern is white



9-6) Definition of contrast ratio for Front light on mode

$$CR = \frac{\text{Luminance when Testing point is White}}{\text{Luminance when Testing point is Black}}$$

10. HANDLING, SAFETY AND ENVIRONMENTAL REQUIREMENTS AND REMARK

WARNING
The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, wash with water and soap.

CAUTION
The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.
Disassembling the display module can cause permanent damage and invalidate the warranty agreements.
IPA solvent can only be applied on active area and the back of a glass. For the rest part, it is not allowed.

Mounting Precautions
(1) It's recommended that you consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
(2) It's recommended that you attach a transparent protective plate to the surface in order to protect the EPD. Transparent protective plate should have sufficient strength in order to resist external force.
(3) You should adopt radiation structure to satisfy the temperature specification.
(4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the PS at high temperature and the latter causes circuit break by electro-chemical reaction.
(5) Do not touch, push or rub the exposed PS with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Some cosmetics deteriorate the PS)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach the PS. Do not use acetone, toluene and alcohol because they cause chemical damage to the PS.
(7) Wipe off saliva or water drops as soon as possible. Their long time contact with PS causes deformations and color fading.

Data sheet status	
Product specification	This data sheet contains preliminary product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

REMARK
All The specifications listed in this document are guaranteed for module only. Post-assembled operation or component(s) may impact module performance or cause unexpected effect or damage and therefore listed specifications is not warranted after any Post-assembled operation.

11. Reliability test

	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T = +50°C, RH = 30% for 240 hrs	IEC 60 068-2-2Bp	
2	Low-Temperature Operation	T = 0°C for 240 hrs	IEC 60 068-2-2Ab	
3	High Temperature, Storage	T = +60°C, RH=26% for 240hrs Test in white pattern	IEC 60 068-2-3CA	
4	Low-Temperature Storage	T = -25°C for 240 hrs Test in white pattern	IEC 60 068-2-1Ab	
5	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA	
6	Temperature Cycle	-25°C → +70°C, 100 Cycles 30min 30min Test in white pattern	IEC 60 068-2-14	
7	Solar radiation test	765 W/m ² for 168hrs, 40°C Test in white pattern	IEC60 068-2-5Sa	
8	Package Vibration	1.04G, Frequency: 10~500Hz Direction: X,Y,Z Duration: 1 hours in each direction	Full packed for shipment	
9	Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3 edges, 6 faces One drop for each.	Full packed for shipment	
10	Electrostatic Effect (non-operating)	(Machine model)+/- 250V 0Ω, 200pF	IEC 62179, IEC 62180	
11	Stylus Tapping	POLYACETAL Pen: Top R:0.8mm Load: 300gf Speed: 2 times/sec Total 13,500times,	-	

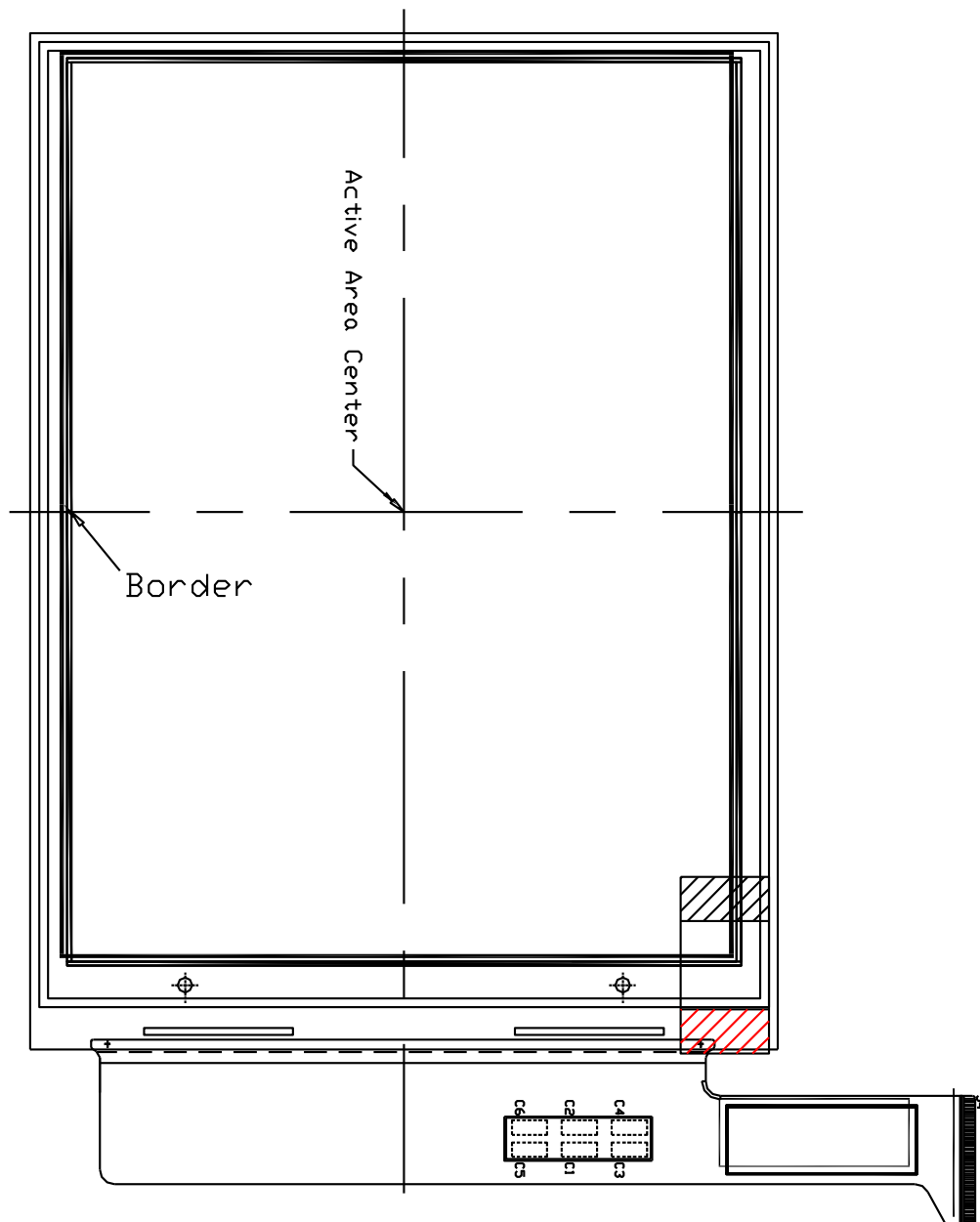
Actual EMC level to be measured on customer application

Note: The protective film must be removed before temperature test.

< Criteria >

In the standard conditions, there is not display function NG issue occurred.
(Including : line defect, no image) All the cosmetic specification is judged before the reliability stress.

12. Border definition



13.Block Diagram

